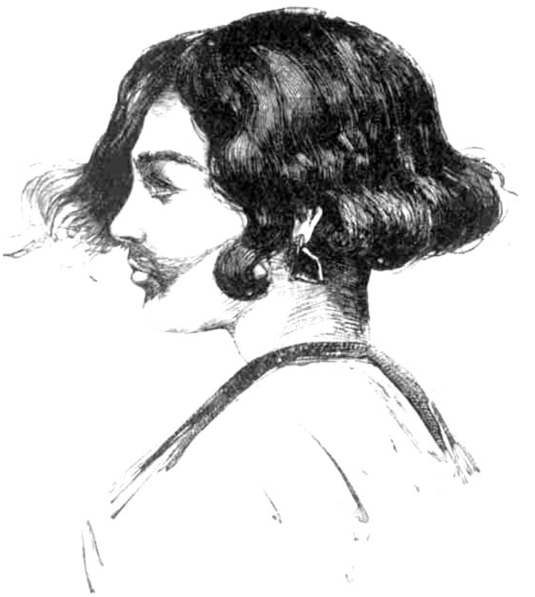
large, with thick, firm lips, and the underlip well developed. The space from the nose to the mouth is extremely long, while the chin, which is rather round, is comparatively short and not very prominent. Thus the face has the shape of a short oval. The profile is concave, and the mouth and eyebrows are prominent . . . . In the supraorbital region the central boss is extremely well marked ; also the brow ridges, which, however, are slightly less conspicuous than the central boss. The ears are usually large, flat, and simply-developed." Mr. Landor shows, by a series of detailed contrasts, that the pure Ainu has no similarity whatever to the Mongolian type. The colour of the skin he found to be light reddish brown. The eye is particularly contrasted to the Mongolian eye, having a similar form and setting to that of North Europeans, while the iris is light brown or dark grey—rarely black or dark brown, except in the case of half-breeds. The eyes are very expressive, and show the emotions in an interesting way. In adults the hair is black, wavy, and inclined to form large curls ; children have lighter hair, and in the north-east of Yezo several men were seen with reddish hair and beard. Mr. Landor never saw the pure Ainu laugh, though on one occasion he induced a man to "roar" with surprise and delight. The various emotions are expressed by slight changes of posture or gesture, but the Ainu do not care to show their feelings ; they have no sense of shame, and even fear appears hardly to be known.



The women do most of the hard work, but the men when hunting can walk forty miles a day without fatigue, although they usually prefer to ride, ponies being plentiful and of a good breed. In moving a load or heavy object the Ainu never push, but always pull towards them. They appear to use the feet and toes very freely to help their hands and fingers, and they readily employ their teeth, preferring to pull with the teeth than the hand when an unusually heavy haul is necessary. The whole appearance struck Mr. Landor as exactly like the reconstructions of the primitive man of northern Europe, and many of their movements recalled those of the anthropoid apes.

In sexual matters the Ainu appear to have no definite rules, but a form of endogamy is common, which scarcely differs from promiscuity. The people are extremely filthy, both in their persons and in their huts, the prevalence of insect parasites being remarkable. They seem to have an acute sense of smell, distinguishing between the odour of an Englishman and a Japanese, but oblivious to their own very marked perfume—an intensified form of the "peculiar odour of an uncleaned monkey's cage." The sense of touch is singularly defective, and even when the extremes are painful, they cannot distinguish the sensation of heat from that of cold. Their hearing is very acute.

Mr. Landor is severe on those writers whose imperfect acquaintance with the Japanese half-castes on the southern coast has led them to theorise on Ainu religion. He acknowledges only "a rudimentary kind of totemism" in connection with the bear festivals, and "a certain amount of fear and respect for anything that supports their life or can destroy it."

In every respect the new observations now published make the Ainu appear to be the most primitive of primitive races in the northern hemisphere. The author brings forward reasons which led him to believe that the Ainu, coming from the north of Asia, and possibly of the same stock as the North Europeans, conquered and dispossessed the Koro-pok-kuru who had come to Yezo from the Aleutian Islands and were akin to the Eskimo.

H. R. M.

THE PURIFICATION OF SEWAGE BY BACTERIA.[1]

THE diffusion of bacteriological knowledge amongst the general public is already beginning to affect the patent list, and numerous inventions which the world is at present asked to take advantage of claim to have some special efficacy in regard to micro-organisms. The pamphlet before us is intended to introduce to public notice one of these bacteriological inventions in a field which has already exercised the ingenuity of many inventors—both professional and amateur—viz., the purification of sewage. In this case the invention is called the "cultivation filter-bed," and the inventor is Mr. Scott Moncrieff, whilst the investigation of its efficiency has been made by Dr. A. C. Houston. The new process of treatment consists essentially in passing the sewage upwards through a filtering medium 14 inches in depth, and composed of successive layers of flint, coke, and gravel. To quote the words of the report, "the *rationale* of this system of sewage disposal seems to depend on the following well-recognised truths :—

"1. That bacteria under favourable conditions are capable of indefinite multiplication.

"2. That bacteria exist in sewage which are capable of peptonising solid organic matter, or, in other words, of preparing it, by a process comparable to that of digestion, for its final disintegration.

"3. That in nature the purification of the refuse of the organic world is effected by the life-history of these or similar micro-organisms."

Having thus learnt what the nature of the method of treatment is—viz. upward filtration without aëration, or, in other words, putrefaction, we turn in the next instance for information as to the effect of this treatment. The report contains a number of analytical tables, but not one of the analyses shows us the composition of the crude sewage, and consequently the numerous analyses of the effluent furnish no data whatsoever as to the purification effected. Turning to the analyses of the effluent, however, we are not surprised to learn that it has generally an unpleasant odour, whilst the albuminoid ammonia in an average sample was 1·1 part per 100,000 ; but why this should be regarded as "very small," we are

---

[1] "Report upon the Scott Moncrieff System for the Bacteriological Purification of Sewage." By Alex. C. Houston, M.B., D.Sc. Edin. (London : Waterlow Bros., 1893.)

©1894 Nature Publishing Group

at a loss to discover. Nor was even the inventor apparently satisfied, for we are told in the report that "in order to still further improve the quality of the effluent by longitudinal filtration, by oxidation, and by the action of micro-organisms, Mr. Scott Moncrieff devised what he has termed nitrifying channels. These in their simplest form consist of half-channel pipes joined together with cement and filled with coke." These channels were originally 30 feet in length, but subsequently they were increased to 80 feet. As regards the efficiency, or rather inefficiency of these channels, we are able to form an opinion from analyses given on pp. 19 and 20 of the report; from these it appears that the free ammonia *before* was 3·2 parts per 100,000, and *after* passing through the 80 feet channel 3·6 parts, whilst the albuminoid ammonia was ·8 part *before*, and ·64 part *after*, respectively, whilst in no case was more than a very small proportion of nitrate discovered in this effluent, showing that these channels are "nitrifying" in name only.

If we now inquire into the machinery involved in producing these results, we find that for a household of ten to twelve persons, the filter-bed was 10 feet long by 2½ feet wide, or 25 square feet in area, whilst the so-called nitrifying channel superadded to this was 80 feet in length (the diameter of these channels is not given). For a population of 1000 persons, therefore, a filter-bed, upwards of 2000 feet square, and a nitrifying channel, between 6000 and 7000 feet in length, would be necessary.

It is difficult to discover what claim to novelty Mr. Moncrieff's system possesses; the upward filtration of sewage was practised years ago, and has been generally abandoned on account of the far superior results obtained by downward intermittent filtration. As regards the nitrifying channels, these are simply downward filters of a very clumsy and expensive form, the inefficiency of which is attested by the analyses published in the report. One novelty indeed there is in Mr. Moncrieff's filters, to which they doubtless owe their "up-to-date" title of "cultivation filter-beds," for we are informed that when a new filter-bed is started it is "inoculated" with the liquid contents of an old one! As already pointed out, in the absence of any analyses of the raw sewage, the report gives us no information as to the work really done by the "cultivation filter-bed," but the effluent coming from it certainly contrasts very unfavourably with good effluents obtained either by filtration, irrigation, or chemical precipitation; as regards the work done by the "nitrifying channels," the analyses demonstrate this to be simply deplorable.

In conclusion, we would remark that the chemical analyses might advantageously have been made more complete, so as to render the figures comparable with those given in the best investigations on the purification of sewage; and we would point out that an analysis is not rendered more exhaustive either by expressing each determination in parts per 100,000 as well as in grains per gallon, or by drawing out the results in elaborate but meaningless curves of divers colours.

ARTHUR MILNES MARSHALL.

A GLOOM has been cast over the opening year by the news of what can only be described as a national calamity. Like his friend, Prof. F. M. Balfour, Milnes Marshall has been cut off in the midst of a life of scientific usefulness by an accident among the mountains which he loved. On the last day of 1893 Prof. Marshall, with several companions, started from the hotel at Wasdale Head for a day's climbing among the precipices of Scawfell. All the dangers and difficulties had been passed, and the party were looking for suitable views to photograph. Dr. Marshall had mounted a few feet higher than the others, and called out, "Here is the best place for the camera," when almost immediately a large stone was seen to fall, followed by his apparently lifeless body. The precise details of the mishap will never be known—whether he stepped or sat down upon a rock loosened by the frost, or whether, as is thought by some well qualified to judge to be more likely, a stone fell upon him from above—must remain a matter for conjecture. The melancholy fact is sufficient that a young and brilliant student of nature passed in an instant from the full enjoyment of health and strength to the "cold obstruction" of death.

Arthur Milnes Marshall was born in 1852, and inherited a love of natural science from his father, a gentleman well known in engineering circles, as well as an enthusiastic naturalist and a microscopist of no mean reputation. He was educated first at a private school, and in 1871 entered St. John's College, Cambridge, where he was one of the earliest students of that school of biology of which he afterwards became so distinguished an ornament. In 1876 he obtained the entrance scholarship in natural science at St. Bartholomew's Hospital, and entered upon the study of medicine. It is hardly too much to say that this step was taken as a *pis aller*. He looked forward with anything but satisfaction to the life of a medical practitioner, and when, in 1879, he was elected to the newly-created chair of zoology in the Owens College, he entered with delight upon a career devoted to the advancement of his favourite science.

As might have been expected from the friend and companion of Balfour his first work was embryological, and consisted of a series of papers on the Cranial Nerves, published in the *Journal of Anatomy and Physiology* and the *Quarterly Journal of Microscopical Science* between the years 1877 and 1881. Though in matters of detail these papers may need correction, and though the "Segmental Value of the Cranial Nerves" is as much open to discussion as it was when Marshall wrote his thesis, these memoirs were at the time solid contributions to our knowledge, and have furnished a basis upon which other men have wrought. The culmination of his work in this direction has been the great work on "Vertebrate Embryology," of which an appreciative notice appeared in these columns so recently that it is not needful to do more than allude to it.

In 1881 the dredging operations of the Birmingham Natural History Society gave him the opportunity of studying the Pennatulida, and in the following year a report upon these animals was issued under the joint authorship of himself and his father. In this and in his subsequent papers on the "Pennatulida of the *Porcupine* and *Triton* Expeditions," and of the "Mergui Archipelago," written partly alone and partly in conjunction with Dr. G. H. Fowler, he carefully elaborated the distinctions between the various forms of zooids and traced the relationships of the genera on morphological grounds. Strong reasons were adduced for dissenting from the classification propounded by Kölliker, though Marshall never considered that he had enough material at command to justify him in proposing an alternative arrangement. On the whole it is probable that these memoirs will form his most lasting contribution to zoological science.

A paper on "The Nervous System of Antedon," containing the results of an Easter vacation spent at Naples, was valuable as establishing beyond question the views of the Carpenters regarding the nervous function of the central capsule and axial cords of Crinoids, but it is still more interesting as an example of Marshall's clear and logical method.

Marshall was a born teacher; his mind was of that rare order which not only sees a problem clearly itself, but is cognisant of every step taken in understanding it, and hence is able to enter into the position of those who approach it for the first time, and to see where their diffi-

©1894 Nature Publishing Group